

REMARKS

Claims 1-6 have been amended. Claim 7 has been cancelled. Claims 8-26 have been withdrawn. Claims 1-6 remain pending in the present application. Reconsideration of the claims, in view of the discussion below, are respectfully requested.

The Office Action objected to claims 2 and 4 for various informalities. The claims have been amended to provide proper antecedent basis, in accordance with the examiner's suggestions. Support for the claim amendments provided herein can be found in the claims and specification of the original application. No new matter is believed to have been added to the application.

REJECTIONS UNDER 35 U.S.C. § 112

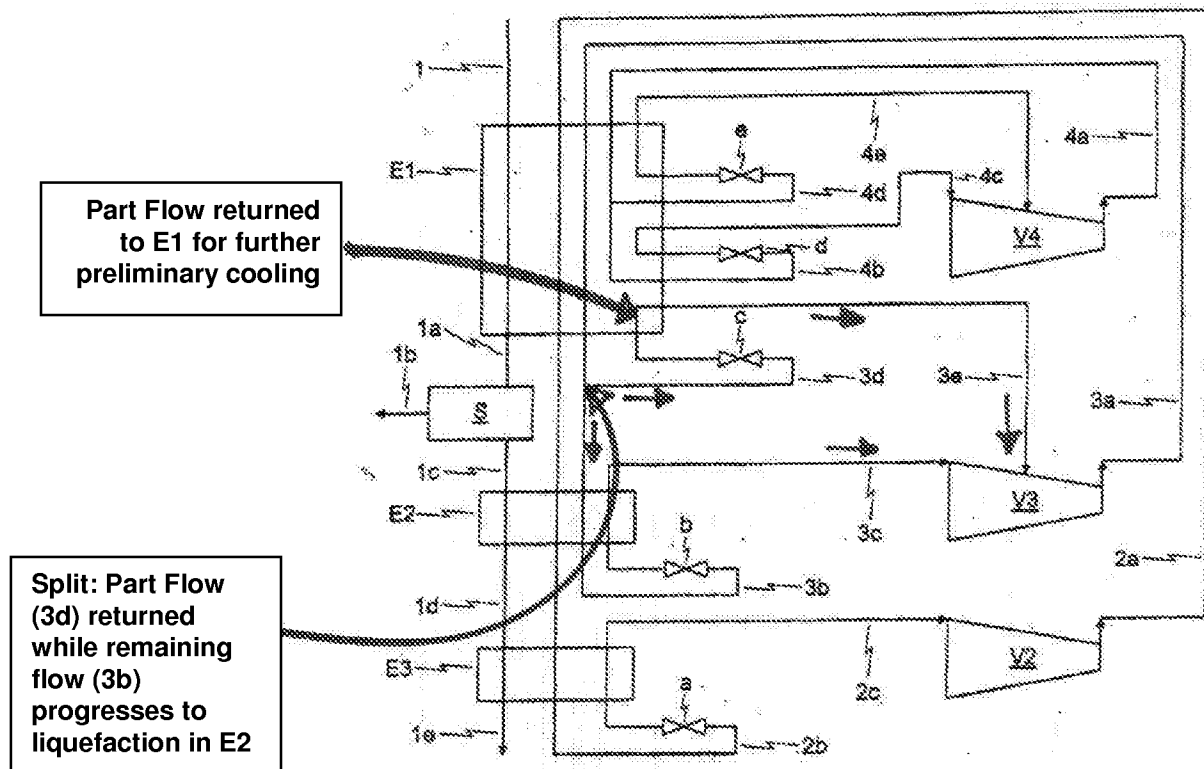
The Office Action has rejected claims 1-6 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Applicants respectfully disagree for the following reasons.

The Office Action states that the recitation "is drawn off after providing preliminary cooling and is returned for additional for the preliminary cooling of the hydrocarbon-rich flow" in claim 1 is indefinite as "there is no discerning what 'for additional for the preliminary cooling' should include."

As an initial matter, claim 1 has been amended to clarify the subject matter which Applicants regard as the invention. As amended, claim 1 recites, in part, "wherein at least one part flow of the refrigerant of the second refrigeration circuit is drawn off a main flow to provide additional preliminary cooling of the hydrocarbon-rich flow, after providing preliminary cooling

and prior to providing liquefaction, and is then returned to the main flow of the second refrigerant circuit.” Applicants maintain that the scope of claim 1 is clear and definite. The specification describes that “a part flow 3d of the refrigerant mixture of the second refrigerant mixture circuit 3a to 3e is drawn off after the heat exchanger E1...Accordingly, the refrigerant mixture part flow 3d...makes a contribution to the pre-cooling of the hydrocarbon-rich flow in heat exchanger E1.” (see paragraph [0065] of U.S. Pre-Grant Publication No. 2008/0006053). Thus, in one aspect, the invention provides preliminary cooling of a hydrocarbon-rich flow in heat exchanger E1. In that aspect, the ‘additional preliminary cooling’ is provided when the refrigerant of the second circuit, after passing through heat exchanger E1, is split, and a part of that flow is directed back through heat exchanger E1 to provide additional cooling.

The Office Action also states that the specification “does not teach that there is a part flow (or any flow) of the second refrigerant that provides preliminary cooling to the hydrocarbon-rich flow and is then returned to provide additional preliminary cooling.” As noted above, the specification (see, for example, paragraphs [0065] through [0067]) describes a part flow of the second circuit that is drawn off after heat exchanger E1, where preliminary cooling occurs, and directed back through E1 to provide additional preliminary cooling. This aspect is further detailed in FIG. 1 of the application, as illustrated below (annotated to show the split of part flows and return to E1 to provide additional preliminary cooling).



Thus, Applicants maintain that claim 1, and the claims that depend therefrom, are clear and definite, and that one of skill in the art could readily determine what “additional preliminary cooling” includes and that a part flow of the second refrigerant circuit provides additional preliminary cooling before being returned to the main flow of the second refrigerant circuit.

REJECTIONS UNDER 35 U.S.C. § 102

The Office Action has rejected claims 1-6 under 35 U.S.C. § 102(b), as allegedly being anticipated by U.S. Patent No. 6,253,574 to Stockman (hereinafter “Stockman”). Applicants respectfully disagree for the following reasons.

The present invention is an improvement on the invention of Stockman. As described in the claims and specification of the present application, the current invention is directed to a

closed-circuit cascade of at least three separate circuits of mixed refrigerants, with each circuit comprising different refrigerants. The first of the three refrigerant circuits is used for pre-cooling (E1), the second for liquefying (E2), and the third for super-cooling (E3) a hydrocarbon-rich flow. The three refrigerant circuits are physically separated and there is no interaction or mixing of the coolants from the three circuits.

In one aspect of the present invention, a portion of the flow in the second circuit is drawn off after the pre-cooling step and is returned for additional pre-cooling before being returned to the main flow of the second section. Thus, at least a portion of the flow of the second circuit passes the pre-cooling step twice, at the same time as the main flow of the second circuit passes the liquefying step twice.

In contrast to the present invention, the refrigerant in the second circuit of Stockman only passes through the pre-cooling circuit heat exchanger once, and then proceeds directly to the liquefaction circuit heat exchanger without any further interaction between the second circuit refrigerant and the pre-cooling circuit heat exchanger. Thus, Stockman fails to disclose or suggest a portion of the flow of the second refrigeration circuit passing through the pre-cooling step twice. For further illustration, Stockman fails to disclose or suggest a part flow such as flow 3d in FIG. 1 of the present application, or that part flow described in the specification of the present application (see paragraphs [0064] to [0069] of the pre-grant publication).

As Stockman fails to disclose the part flow recited in amended claim 1, Stockman does not anticipate the claims of the present application. Accordingly, this rejection should be withdrawn.

The Office Action has rejected claims 1 and 3-6 under 35 U.S.C. § 102(b), as allegedly being anticipated by U.S. Patent No. 5,768,912 to Dubar (hereinafter "Dubar"). The Office

Action has also rejected claims 1 and 5-6 under 35 U.S.C. § 102(b), as allegedly being anticipated by U.S. Patent No. 4,539,028 to Paradowski (hereinafter “Paradowski”). Applicants respectfully disagree for the following reasons.

Both Dubar and Paradowski each discloses a system comprising a single refrigeration circuit that is branched off for each refrigeration step. Neither Dubar nor Paradowski disclose a system having individual, physically separated circuits. In addition, neither Dubar nor Paradowski disclose the feature of the present invention wherein a part flow of a second refrigeration circuit, after providing preliminary cooling and prior to liquefaction, is returned to provide additional preliminary cooling. Accordingly, the claims of the present application are not anticipated by either Dubar or Paradowski, and these rejections should be withdrawn.

REJECTIONS UNDER 35 U.S.C. § 103

The Office Action has rejected claims 1-6 under 35 U.S.C. § 103(a), as allegedly being obvious over U.S. Patent No. 3,315,477 to Carr (hereinafter “Carr”), in view of Stockman. Applicants respectfully disagree for the following reasons.

As described above, Stockman fails to teach or suggest the part flow recited in claim 1 that is returned, after preliminary cooling and prior to liquefaction, to provide additional preliminary cooling. Advantages of the inventive features of the present invention are that the arrangement of the second circuit can contribute to the pre-cooling of the gas stream and that the distribution of cooling capacity of the second circuit can be controlled almost at will. Carr teaches a system comprising a single refrigeration circuit that is branched off for each refrigeration step. Carr fails to teach or suggest a system having individual, physically separated circuits, or a system wherein a part flow of a second refrigeration circuit, after providing

preliminary cooling and prior to liquefaction, is returned to provide additional preliminary cooling. Even if Stockman and Carr were combined, the combination would not provide all of the features of the claimed invention or the advantages of the present invention described above. Accordingly, the combination of Stockman and Carr would not have rendered the present invention obvious and this rejection should be withdrawn.

The Office Action has rejected claims 1-6 under 35 U.S.C. § 103(a), as allegedly being obvious over U.S. Patent No. 3,413,816 to Marco (hereinafter “Marco”), in view of Stockman. Applicants respectfully disagree for the following reasons.

As described above, Stockman fails to teach or suggest the part flow recited in claim 1 that is returned, after preliminary cooling and prior to liquefaction, to provide additional preliminary cooling. Advantages of the inventive features of the present invention are that the arrangement of the second circuit can contribute to the pre-cooling of the gas stream and that the distribution of cooling capacity of the second circuit can be controlled almost at will. Marco teaches a system comprising a single refrigeration circuit that is branched off for each refrigeration step. Marco fails to teach or suggest a system having individual, physically separated circuits, or a system wherein a part flow of a second refrigeration circuit, after providing preliminary cooling and prior to liquefaction, is returned to provide additional preliminary cooling. Even if Stockman and Marco were combined, the combination would not provide all of the features of the claimed invention or the advantages of the present invention described above. Accordingly, the combination of Stockman and Marco would not have rendered the present invention obvious and this rejection should be withdrawn.

CONCLUSION

Applicants respectfully requests entry of the amendments and consideration of the remarks herein. Examiner is invited to contact the undersigned if deemed helpful to facilitate prosecution of the application to issuance.

A credit card payment is submitted *via* EFS Web in the amount of \$940.00, representing the large entity fees for a Request for Continued Examination under 37 C.F.R. § 1.17(e) and a Request for a One-Month Extension of Time under 37 C.F.R. § 1.17(a)(1). This amount is believed to be correct; however, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Respectfully submitted,

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